3.4 Challenges and Data Gaps

Many of the specific data gaps related to development of the described indicators and their ability to answer the questions posed have already been identified. The discussion below augments the previously identified gaps.

3.4.1 Land Use

The ability to accurately characterize and track land use over time is limited. Various federal efforts, such as the USDA NRCS, NRI, the USDA Forest Service FIA, the U.S. Fish and Wildlife Service (USFWS) Status and Trends Program, and the NLCD, contribute in part to tracking some land uses and a variety of cover types. None of these are comprehensive for all lands or land uses, and some have limitations in their frequency of data collection or analysis. Some cover types and land uses are not sampled in any detail, including private and federal desert lands, federal shrublands and grasslands, and rangeland. In addition, Alaska is seldom included in national inventories, although Alaska represents approximately 16 percent of the land area of the U.S. and includes extensive shrublands, grasslands, and tundra.

Each of the national systems has developed different methods, definitions, and classification criteria. While some effort has been made to share definitions across some of these systems (e.g., the NRI and FIA systems use essentially the same definition of forest land, and NRI and FWS define wetlands similarly), not all are consistent, especially in descriptions of developed or urban land, cropland, and rangeland. Examples of differences in classifications and acreage from several current national efforts are shown in Exhibit 3-31 for developed and agricultural land uses. The NLCD uses different classification and land use definitions because it is based on remote sensing data (an aerial perspective) rather than on ground sampling. FWS information is also based on aerial photo interpretation. Given the increasing availability of high resolution aerial imagery, remotely sensed techniques for land cover delineations are likely to increase and classifications based on this inventory approach should be coordinated and defined.

Another challenge is developing data on uses and cover types that at present are not adequately sampled. Further challenges include effectively integrating and harmonizing the various results of multi-agency, as well as state and local, efforts and coordinating the limited resources dedicated to national tracking of land cover/land use changes among agencies, so that inventories can be performed as frequently and as comprehensively as possible. The overarching goal is to assess national patterns in such a way that changes in land cover and land use that might have implications for human health or ecological condition can be detected and addressed.

Exhibit 3-31: Land cover/land use estimates

Data Source	Developed Land	Agricultural Land
National Resources Inventory (NRI)[A]	98 million acres developed land	377 million acres cropland 32 million acres Conservation Reserve Program land 120 million acres pastureland
The Heinz Center[B]	32 million acres urban and suburban land	430-500 million acres cropland, hayland, and pastureland
U.S. Census Bureau[C]	47 million acres urbanized areas 13 million acres urban clusters	No data
National Land Cover Data (NLCD)[D]	36.7 million acres low and high density residential and commercial/industrial/ transportation	331 million acres cropland 179 million acres pastureland and hayland

Note: The NRI, Heinz Center, and NLCD sources do not include Alaska as part of the estimates.

[A] USDA, Natural Resources Conservation Service. *Summary Report: 1997 National Resources Inventory (Revised December 2000)*. 2000.
[B] The Heinz Center. *The State of the Nation's Ecosystems*. 2002.
[C] U.S. Census Bureau. Corrected Lists of Urbanized Areas and Urban Clusters. November 25, 2002. (March 2003; *http://www.census.gov/geo/www/ua/ua_state_corr.txt and http://www.census.gov/geo/www/ua/uc_state_corr.txt*).
[D] USGS, National Land Cover Dataset. NLCD Land Cover Statistics. 2001. (March 2003; *http://landcover.usgs.gov/nlcd.html*).

The data available that actually summarize a national picture of land use are extremely limited. Relatively little comprehensive information exists about federal land management practices and extent. For example, while the USDA Forest Service tracks acres managed for timber production, data are not easily accessible on acres used for grazing; oil, gas, and mineral development; or recreation. Data needed to summarize all lands under some form of "protection," such as parks, wilderness areas, reserves, or conservation easements at all levels of government, do not exist.

In many cases, where land is used to produce food or fiber, indicators that report the amounts and values of these commodities might be used to identify the condition/stress/pressure on the land. Examples of commodities include agricultural products, forest products, and cattle produced from grazing land. The amount of fresh water used by humans might also be a good indicator of the pressure being applied to land and water resources. Commodity production is commonly correlated closely to population growth. Reporting of commodity production trends in agriculture and forestry might also provide another view of the effects of these activities on the land and help evaluate policy options for ensuring long term, sustainable commodity production while reducing environmental effects.

Land provides many other benefits in addition to commodity production. Research is being conducted on the subject of quantifying these "ecosystem services." Indicators are needed that will enable measuring and tracking some of these services.

3.4.2 Chemicals

Most of the national efforts to track chemical usage focus on how much is produced, used, or released, with less emphasis on tracking the extent or area of use. The TRI database requires reporting of releases of certain volumes of specific chemicals, but aside from knowing the location of initial releases, it does not track the extent of the area that might in some way be affected by the chemicals. In addition, pesticide and fertilizer use are primarily tracked by understanding where these chemicals are sold, rather than where they are actually used.

Further, not all toxic chemicals are on the list of TRI chemicals and, therefore, some toxics are not reported. The TRI program faces the challenge of maintaining a current list that reflects the constant development, use, and release of new chemicals that might have effects on human and ecological health.

Indicators for pesticide residue in food, potential pesticide runoff from farmlands, risk of nitrogen runoff, and risk of phosphorus runoff all address some part of the question of potential chemical disposition. Only the indicator for pesticide residues in food, however, goes beyond stating the potential for chemicals to leave their point of use and actually shows the potential for consumers to be exposed to these chemicals. Indicators to better understand the actual disposition of chemicals, rather than potential disposition, would be useful to correlate with actual human health and ecological condition indicators.

State Pesticide Use Reporting Systems

While there is no national pesticide use reporting system, several state systems exist. For example, California, with the most advanced system in the country, has had full pesticide use reporting since 1990. Reports about the specifics of application are filed by large- and small-scale farmers, commercial agricultural pesticide applicators, structural pest control companies, and commercial landscaping firms. (California Department of Pesticide Regulation, 2000.)

Better indicators of the linkages between chemical applications on the landscape and chemicals that find their way into the bodies of humans and other species are needed. This includes better information on the chemistry, quantities, and longevity of various substances; on the cumulative effects of various chemicals on the environment and humans; and on the pathways and effects of exposure. In cases where nutrients do reach receiving waterbodies and raise the concentrations above background levels, considerable uncertainty still exists concerning ultimate ecological effects. Current research does not clearly quantify the relationship between raised nutrient levels and resulting ecological changes.

Better information is needed to provide an accurate picture of the human health effects of pesticide use. This information is difficult to collect, however. Even in California, where significant resources are dedicated to pesticide regulation, the best available indicator is a measure of reported illnesses and injuries from pesticide exposure in the workplace. While this is valuable information, it does not address potential long-term health effects of non-workplace exposure that might result through drinking water and food exposure.

3.4.3 Waste and Lands Used for Waste Management

Several challenges and data gaps limit the understanding of waste and its effects on human health and ecological condition. First, as noted, waste data tend to be developed in response to the requirements of specific mandates or regulations. Because these regulations do not apply to all types of waste and are carried out at different levels of government, and in the private sector, complete data do not exist to answer the question: "How much waste is generated?" Additionally, most waste generation is reported only by weight, providing little understanding of the volume of waste produced.

Information about the amount of waste generated does not provide a complete picture on either the extent of waste-related problems or the effects of waste on human health, ecosystems, or the ambient environment. Different waste types pose substantially different types of risks. Some wastes are known to be hazardous to humans and the environment, but specifics about exposures and the effects of many other waste types are not well understood and data are limited. Finally, the risks posed by waste are largely a function of the type and effectiveness of waste management. The available data on waste and waste management have been limited by the stringent regulatory requirements and definitions that have driven most of the national information collection efforts.

Data to describe how lands are affected by waste management are also limited. Even basic statistics on the acreage of lands used for managing waste and the condition of those lands are not available at the national level. To gain a more complete understanding of the extent and effects of land used for waste management would require information on waste management methods, standards, and compliance, as well as information on lands where illegal dumping occurs. Establishing linkages to human populations or ecosystems within close proximity to lands managed for waste is an additional challenge.

3.4.4 Contaminated Land

Today, the best available information used to describe extent of contaminated land includes measures of the number and location of sites. two indicators of contaminated land that lack national-quality data are the extent of contaminated land and the effects of contamination.

Determining the extent of contaminated land would require national-level information on the number, location, and area of contaminated lands, and data on the specific site contaminants and the associated risks, hazards, and potential exposures. Additional factors such as the potential contamination of ground water sources and the transportation or disposal methods needed to clean up the contamination would have to be considered. Such data are currently captured for only a subset of the nation's contaminated lands. In addition, information on known contaminated lands (e.g., some sites in EPA's Comprehensive Environmental Response, Compensation, and Liability Information System) that are not on the Superfund's NPL, data in state and local databases, and information on the other types of contaminated lands (e.g., leaking underground storage tanks) are not captured in the existing data.